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ORIGINAL PAPER

Quality of Web-based Information on Pathological Gambling

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Abstract The present study aims to evaluate the quality of web-based information on gambling and to investigate potential content quality indicators. The following key words: gambling, pathological gambling, excessive gambling, gambling problem and gambling addiction were entered into two popular search engines: Google and Yahoo. Websites were assessed with a standardized proforma designed to rate sites on the basis of "accountability", "presentation", "interactivity", "readability" and "content quality". "Health on the Net" (HON) quality label, and DISCERN scale scores aiding people without content expertise to assess quality of written health publication were used to verify their efficiency as quality indicators. Of the 200 links identified, 75 websites were included. The results of the study indicate low scores on each of the measures. A composite global score appeared as a good content quality indicator. While gambling-related education websites for patients are common, their global quality is poor. There is a need for useful evidence-based information about gambling on the web. As the phenomenon has greatly increased, it could be relevant for Internet sites to improve their content by using global score as a quality indicator.

Keywords Internet · Quality indicators · Health care · Gambling · Addiction

Introduction

Medical websites on Internet are frequently used as a source of information on health issues (de Boer et al. 2007; Powell and Clarke 2002), mostly to seek information or advice on condition, symptoms, diseases, or treatment (Shuyler and Knight 2003). The large and rapid expansion of gambling on the Internet, (Griffiths 2003; Petry and Weinstock 2007) urgently requires diffusion of accurate information on pathological gambling on the web, one of the leading areas of development of gambling. Importance of online research of medical information, development of patient education and counseling and the possible impact web content on health-related attitudes as well as physician–patient relationship

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(Wald et al. 2007) argue for a serious development of pathological gambling-related websites.

Increasing prevalence of pathological gambling, a common impulse control disorder (Cox et al. 2005), is possibly associated to a large diffusion of Internet gambling (Petry and Weinstock 2007). The disorder is associated with an increased risk of mood (Moodie and Finnigan 2006), anxiety disorder (el-Guebaly et al. 2006) or substance abuse (el-Guebaly et al. 2006). There is however a considerable gap between estimated prevalence and treatment prevalence (Queri et al. 2007; Evans and Delfabbro 2005). Only a relatively small proportion of people with pathological gambling seek professional help. The phenomenon is probably due to several factors such as: stigma or shame associated to pathological gambling, treatment availability or concerns about treatment as well as lack of the recognition of problematic behavior (Evans and Delfabbro 2005; Rockloff and Schofield 2004). The anonymousness of Internet, which is frequently used for gambling (Griffiths 2003) may increasingly become a key source of information for people with gambling related problems, emphasizing thus the importance of quality assurance for specific websites.

The overall web-based health information designed for consumers seems to be poor. A systematic review assessing the quality of consumer health information on the Internet reveals that 70% of papers conclude that quality is a problem (Eysenbach et al. 2002).

In response to these concerns, a number of initiatives have been developed to establish health-related websites quality criteria. There is a general agreement on the characteristics of a good website (Jadad and Gagliardi 1998; Silberg et al. 1997) including: quality of content, design and aesthetics of the site, readability, dating of information, authority of source, ease of use, accessibility and disclosure of authors and sponsors. Health on the Net foundation (HON), amongst others, has issued a code of conduct for medical sites covering much of the above mentioned (Boyer et al. 1998a, b) and attributes a quality label taking into account the following points: disclosure of authorship, sources, updating of information, disclosure of editorial and publicity policy, as well as confidentiality.

To our knowledge, there are currently no studies that have systematically assessed the quality of English language web-based information on gambling. This study aims firstly to systematically assess content quality (evidence-based health information), accountability (authorship, attribution) and readability (text difficulty and legibility) of Internet information on pathological gambling using a standardized proforma based on previously published work assessing quality of web-based information (Abbott 2000; Griffiths and Christensen 2000). Secondly, the study aims to determine content quality indicators.

Method

A typical search was performed to produce a list of websites similar to the one generated by a common user with limited medical or Internet knowledge.

Selection of Websites

In September 2007, keyword searches were performed on the Internet to identify websites providing information on gambling. The following keywords were entered: gambling, pathological gambling, excessive gambling, gambling problem and gambling addiction into two of the most popular World Wide Web search engines: Google and Yahoo.

The first 20 English language websites coming-up from each keyword query were examined given that most people rarely search beyond the first 20 links (Eysenbach et al. 2002).

Sites were excluded if: inaccessible, already reviewed in the current study, containing no information on gambling, requiring access fee, discussion group or open forum, not a site (external links, books or articles) and if contained no information in English.

Evaluation of the Websites

Websites' affiliations were divided into five categories: commercial, university, non-profit organization, governmental and "other" according to the suffix (.gov: government; .edu: university; .com: commercial; .org: non-profit organization) as well as to the declaration of affiliation. Presence or absence of HON logo was also considered.

The standardized proforma is similar to the one previously used for other health-related problems (Khazaal et al. 2007) and contained the following sections:

- "Accountability" (Griffiths and Christensen 2000; Silberg et al. 1997) with assessment using a nine-point scale to rate sites based on criteria of authorship: whether authors and their affiliation and credentials were identified; attribution: whether sources and references were mentioned; disclosure: whether ownership of the site, sponsoring and advertising were disclosed; and currency: whether the date of creation and modification of the site has been specified.
- "Interactivity" was measured by using an adaptation of Abbot's scale (Abbott 2000). The following aspects were evaluated: the presence of an internal site search engine, the presence of audio or video support, the presence of satisfaction and knowledge evaluation questionnaires for users, the presence of supporting bodies (forums, discussion rooms), and the possibility of sending queries to the webmaster or authors.
- "Presentation" was evaluated with the Abbott's aesthetic criteria (Abbott 2000) adapted by Kisely et al. (2003). These cover the presence of headings, subheadings, diagrams, hyperlinks as well as absence of advertising.
- "Readability" was assessed using the Flesch-Kincaid reading ease score and the Flesch-Kincaid education score (Kisely et al. 2003). The first, the Flesch-Kincaid reading ease score, evaluates text difficulty in regard to USA school grades. Higher scores reflect a higher level of difficulty. A score of 8, the recommended level for standard documents, means that an eighth grade student is capable of easily understanding the document. The second, the Flesch-Kincaid education score (Kisely et al. 2003), is included in the Microsoft word spellchecker. Scores range from 0 to 100, with higher scores reflecting higher legibility. Readability scores were computed with mathematical formulas treating number of words, sentences and syllables.
- Content quality was evaluated based on the availability of responses to probable queries. The choice of question type focused on advice for treatment and information concerning diseases, as these are common queries on the Internet (Shuyler and Knight 2003). Content quality was examined on the following six points, including questions: (1) « How can I know if I am suffering from pathological gambling? » (definition); (2) gambling etiology; (3) possible social and psychological complications of gambling; (4) gambling withdrawal; (5) pharmacological treatment options and limitations; (6) motivational and psychotherapeutic treatments. Comparison of information found was done in consensus with field experts (practice guidelines for treating gambling-related problems. Developed by the Massachusetts Council on compulsive gambling, January

2004). Coverage and correctness of medical information were evaluated. The coverage of a topic ("exhaustibility") was characterized as "none", "minimal" and "sufficient" (0–2 points). Correctness of information ("accuracy") was characterized as "mostly not", "mostly" and "completely right" (0–2 points) (Nilsson-Ihrfelt et al. 2004). Content quality scores for given sites correspond to the sum of exhaustibility and accuracy for the six studied aspects, amounting to a maximum total of 24 points.

A Global score was defined as the sum of Silberg (accountability), interactivity, Abbott's esthetic criteria and content quality scores, each item weighed equally as in previous studies (Griffiths and Christensen 2000).

Finally the DISCERN scale was used which intends to assist people without content expertise to assess the quality of written health attributes of a publication, such as the extent to which the information appears balanced and unbiased (Charnock et al. 1999). The instrument comprises 15 items and an additional overall quality item (each rated from 1 to 5). There are however few studies on the validity of DISCERN as an indicator of the content accuracy of health web materials. An association was previously found between adherence to clinical practice guidelines and DISCERN scores (Griffiths and Christensen 2002). Previous studies show that consumers and health professionals DISCERN ratings were significantly correlated (Griffiths and Christensen 2005).

Inter-rater reliability of proforma scores was assessed based on a random sample of sites with two evaluators.

Analyses

Statistical analyses were performed using SPSS for Windows (Version 11.0). An initial exploratory analysis involved the calculation of proportions as well as means and standard deviation of the outcome values.

Student's *t*-tests were used to test the equivalence of means in main outcome measures in the two groups (with and without HON label).

The main analysis consisted in prediction of content quality of websites dealing with gambling disorder through multiple linear regression. However, factor analysis was firstly used to reduce interrelated variables with quantitative values to a more meaningful, smaller set of uncorrelated variables on an exploratory basis. Five original variables were then reduced, namely: the Silberg scores, the Interactivity scores, the Abbott aesthetic criteria scores, the Flesch reading ease scores and the Flesch-Kincaid education scores. The Global scores and the DISCERN scores are not considered in this Factor analysis since they are two different tools used by professionals and non-professionals to evaluate the content quality of a site. To evaluate acceptability of Factor analysis we used the Kaiser–Meyer–Olkin (KMO) and Bartlett's tests to measure sampling adequacy. The KMO measure should be equal or greater than 0.5 to proceed with Factor analysis, while the Barlett's test of sphericity should be statistically significant at the 0.05 level, meaning that the correlation matrix is not an identity matrix.

Two decision-making criteria for factor retention were used: the Kaiser rule and the Cattell scree plot obtained by principal components extraction. The Kaiser rule states that all factors with eigen values greater than 1 should be retained. Although this rule may seem conservative, one has to bear in mind that eigen values less than 1 originate from factors that account for less variance than in the original variables. The Cattell scree plot, i.e. a graph which shows the magnitude of the eigen values versus the components serving to confirm these factors: the rule being that factors above the inflexion point of the slope must

be retained. The extraction of the factors was made by variance maximizing (varimax) rotation of the original variable space, ensuring that these factors are uncorrelated or orthogonal to each other. The significant factors extracted, the global scores, the DISCERN scores and other categorical variables not suitable for factor analysis were then analyzed together through a multiple linear regression for the prediction of content quality. Finally, assumptions of independent normally distributed errors and constant variance of errors were checked by studying the residuals from the model. Potential co-linearity among the independent variables was studied through the variance inflation factor (VIF) value. Finally, relevancy of the model was assessed through the coefficient of determination: the adjusted R^2 statistic.

For all analyses, a significance level of $p \leq 0.05$ was used.

Results

Two hundred links were reviewed. A sensible overlap in the sites identified by the two search engines and the five keywords (72/200: 36%) meant 128 websites were retained. Of these, 53 were excluded for the following reasons: 15 contained no information on gambling; 12 were inaccessible; 22 were not websites (only external links or books) and 4 were not in English. Seventy-five sites were therefore included in our study. The studied websites contain information on pathological gambling but none of them offer online treatment for pathologic gambling.

The sites were assessed with the proforma which presents a good inter-rater reliability for all items: Silberg ($r = 0.950$; $p < 0.05$), Flesh Reading ease ($r = 0.850$; $p < 0.05$), Flesch Kincaid level ($r = 0.765$; $p < 0.01$), Abbott's esthetic criteria ($r = 0.905$; $p < 0.05$), DISCERN ($r = 0.950$; $p < 0.01$), content quality ($r = 0.963$; $p < 0.01$), interactivity ($r = 0.763$; $p < 0.01$).

The origin of the sites is as follows (government: 10, university: 7, commercial: 28, non-profit organization: 30). Among the 75 sites, only 5 (6.7%) presented the HON logo. While English language was an inclusion criterion, 5.3% of the sites contained information in German, 18.7% in Spanish and 13.3% in several other languages. A majority of the sites (54.7%) recommended that a qualified professional should be consulted for advice.

Main outcome means and standard deviation (SD) of the websites are the following (Table 1): regarding "accountability", the mean score was 4 (out of 9; SD 2). Some sites specified when they had been created (57.4%) and only 31.1% reported content

Table 1 Detailed main quality outcome measures of the studied websites

Outcome	Mean (SD)
Silberg scores (0–9)	4 (2)
Interactivity scores (0–6)	2.07 (1.04)
Abbott aesthetic criteria scores (0–4)	2.8 (0.6)
Flesch reading ease scores	48.8 (10.8)
Flesch-Kincaid education scores (1–12)	8.5 (2.1)
Content quality scores (0–24)	12.5 (4.9)
Global scores (0–43)	21.6 (6)
DISCERN scores (16–80)	35.3 (8.2)

Table 2 Comparison of quality outcome scores of sites with and without HON label

	With HON label ($n = 5$)	Without HON label ($n = 70$)	T	p-Value
Silberg scores (0–9)	5 (1.2)	3.9 (2.1)	−1.12	ns
Interactivity scores (0–6)	2.4 (0.5)	2 (1.1)	−0.73	ns
Abbott aesthetic criteria scores (0–4)	2.4 (0.5)	2.8 (0.6)	1.32	ns
Flesch reading ease scores (0–100)	47 (16.7)	48.8 (10.4)	0.37	ns
Flesch-Kincaid education scores (1–12)	8.5 (3.3)	8.5 (2)	0.02	ns
Content quality scores (0–24)	13.6 (6.8)	12.4 (4.8)	−0.53	ns
Global scores (0–43)	23.4 (7)	21.4 (6)	−0.70	ns
DISCERN scores (16–80)	37 (8.5)	35.2 (8.2)	−0.47	ns

modification during the prior 6 months. Sources of references were mentioned by 49.3% of sites. Sponsoring or absence of sponsoring was reported for 32% of sites.

Regarding "interactivity", the mean level was low 2.07 (out of 6; SD 1.04). Audio or video support were used in only 9% of the sites, intra-site search engine appeared in 66.7% of websites, support groups in 13.3% and the possibility to send queries to a web master in 88%.

Regarding "presentation", the mean score was 2.8 (out of 4; SD 0.6).

Concerning "readability", the average Flesch-Kincaid education score was 8.5 (SD 2.1) which is higher than the recommended level of 8 for most standard documents. The mean Flesch-Kincaid reading ease score was 48.8 (SD 10.8).

Regarding the "content quality", the average score was 12.5 (out of 24; SD 4.9) and was highly variable (3–23).

Finally, the mean global score was 21.6 (out of 43; SD 6) and the mean DISCERN score was 35.3 (out of 80; SD 8.2 which is low.

As shown in Table 2, there was no statistically significant difference between sites with ($n = 5$) or without ($n = 70$) HON label on the evaluated criteria.

The KMO measure almost reaches the recommended value of 0.5 and the Barlett's test is significant at $p < 0.0005$. By principal components method, two factors have been extracted with eigen values greater than 1. Similarly, the Cattell scree plot also produced by the principal component method confirmed the presence of these two factors. Looking at the rotated component matrix (see Table 3), we see that the variables "Flesch reading

Table 3 Rotated component matrix

Variable	Component	
	1	2
Flesch-Kincaid education score (1–12)	−0.944	
Flesch-Kincaid reading ease scores (0–100)	0.894	
"Presentation" scores (0–6)		0.648
Silberg "accountability" scores (0–9)		0.797

Extraction method: principal component analysis; rotation method: Varimax with Kaiser normalization; rotation converged in three iterations

ease scores and the Flesch-Kincaid education scores" load on factor 1. The items sorted in this factor express an ability to read the information given by the site and could be combined into a scale labeled "readability". The "Interactivity scores" and the Silberg scores *load* on factor 2 thereafter named "accountability and interactivity". These two factors accounted for more than 65% of item variance, with factor 1 accounting for 41.59% and factor 2 for 23.64%.

The two factors ("readability" and "accountability and interactivity"), the Global scores and the categorical variables not suitable for factor analysis like the origin of the site (commercial versus non-commercial), and the HON label (yes versus no) were analyzed through a multiple linear regression to predict the content quality of a site. The non-commercial sites and the sites with the HON label were taken as the reference category. Preliminary partial correlation test shows no association between the dependent variable and the DISCERN variable when controlled for global scores. Therefore, the DISCERN variable was not considered in the regression.

The following model was studied:

$$\begin{aligned}\text{content quality} = {} & \beta_0 + \beta_1 \,\text{readability} + \beta 2\ \text{accountability and interactivity} \\ & + \beta_3 \,\text{global score} + \beta_4 \,\text{site origin} + \beta_5 \text{HON label} + \varepsilon\end{aligned}$$

where ε is the error term.

The overall F statistic of the regression is significant at $p < 0.0005$, rejecting the null hypothesis that the population multiple correlation is 0. The adjusted R^2 statistic showed that 87.3% of the total variation in the outcome variable was explained by a final model including factor 1 (readability), factor 2 (accountability and interactivity), and global scores however not by origin of the site or HON label.

No problem of multi-co-linearity was detected as can be attested by the weak value obtained for the variance inflation factor (VIF max = 1.2), signifying that the contribution of each independent variable to the prediction is unique. No leverage value exceeded 0.16. For finding sites whose predicted scores are quite different from their actual scores, the standardized residuals were used. Standardized residuals greater than 3 in absolute value were declared outliers. Leverage elements were outliers on the set of predictors whose value exceed 3*(k + 1)/n1. (k: number of predictors and n the sample size). Two outliers were detected. Looking back at the data, these values concerned one commercial site and one governmental site with Cook's distance values exceeding 1. This finding means that these two cases influence simultaneously the dependent variable and the set of predictors. Testing the assumptions of the linear regression model involves the graphing of the residuals against the predicted values. Abnormal patterns indicating strong violation of linear regression assumptions lead to a new regression being fit without the above-mentioned two influential cases.

This new regression significantly improved the R^2 statistic (97.4%) without much changing the regression coefficients. Moreover, the graph of the residuals against the predicted values showed that the assumptions of independent normally distributed errors and constant variance of errors were met.

Hence, the final model retained was:

$$\begin{aligned}\text{content quality} = {} & \beta_0 + \beta_1 \,\text{readability} + \beta_2 \,(\text{accountability and interactivity}) \\ & + \beta_3 \,\text{global score} + \varepsilon\end{aligned}$$

The estimates of the model coefficients β_0, β_1, β_2, and β_3 and their associated confidence interval are:

−7.9 [−8.7, −7], −0.5 [−0.7, −0.3], −2.3 [−2.5, −2], 0.95[0.92, 0.95], respectively. All the regression coefficients are significant at $p < 0.0005$.

The estimated model is then:

$$\begin{aligned}\text{content quality} = {} & -7.9 - 0.5x\,\text{readability} \\ & - 2.3x(\text{accountability and interactivity}) + 0.95x\,\text{global score}\end{aligned}$$

where the predicted mean of content quality is 12.45 (SD = 4.95).

The results suggest that content quality of web sites dealing with gambling is significantly explained by readability, accountability and interactivity and global scores but not by presence of HON label and site origin.

Discussion and Conclusion

Discussion

The present study plans to systematically assess the quality, accountability and readability of Internet information on gambling and content quality indicators. The results of the present study indicate that quality of information on gambling on the web is commonly poor, confirming previous studies on other health issues (Coquard and Khazaal 2007; Eysenbach et al. 2002; Griffiths and Christensen 2000; Khazaal et al. 2007; Wyatt 1997). Furthermore, universities seem to be poorly active in proposing websites. The DISCERN score did not predict content quality which is in discordance with some previous studies (Khazaal et al. 2007; Griffiths 2002, p. 158; Griffiths and Christensen 2005) but not others (Morel et al. 2008). There are still only a few studies on the validity of DISCERN as indicator of the content quality of health websites (Wyatt 1997). Likewise, as previously reported in some studies (Morel et al. 2008) but not in others (Khazaal et al. 2007), the HON label fails to predict content quality and no differences were shown between sites with this label and others. Larger studies, including more sites with the HON label may help to evaluate its usefulness as a content quality indicator.

The origin of the sites (university, commercial...) does not predict content quality. This is possibly due to the small number of sites in categories other than commercial site.

In the study at hand, "accountability and interactivity" and "readability" predict negatively the content quality. This result which was also reported in previous studies (Griffiths and Christensen 2002; Hargrave et al. 2003; Morel et al. 2008) may mirror different conceptions of websites (more interactive, less informative vs. more informative, less interactive).

The present study has several limitations, as it only gives account of gambling related websites in September 2007. Two general search engines were used rather than medical search engines, which, are however more popular among general population, and most likely to lead to results similar to those previously shown (Ilic et al. 2003). In addition, the study may not replicate behavior of all Internet consumers who may use differing search methods in regard to search engines, keywords used, links explored, and time spent searching for information.

Conclusion

Despite limitations previously acknowledged, the study confirms the poor quality of websites, based on evaluation tools and a standardized research method capable of

reflecting a common user's Internet search in English on pathological gambling. The Study shows the importance of a global score as content quality indicator as well as a negative link between accountability/interactivity, readability and content quality. It could then be helpful for people to be informed on global score as a quality indicator. It remains however a complex measure. Development of easier quality indicator for general customer is therefore recommended. In spite of this, gambling and health-related Internet sites could however improve their content using this quality indicator.

The expansion of health-related education and counseling on the web, the poor and variable quality of websites, and the possible effect of web content on health-related attitudes as well as physician–patient relationship (McMullan 2006; Wald et al. 2007) argue for a real and direct provider-patient talk concerning health information found on the Internet (Wald et al. 2007).

Development of good quality websites for gambling related problems are necessary, especially in the current circumstance of Internet-gambling expansion. In parallel, diffusion of online interactive gambling treatment is also a probable avenue of progress. The issue merits greater involvement on behalf of university and academic centers.

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